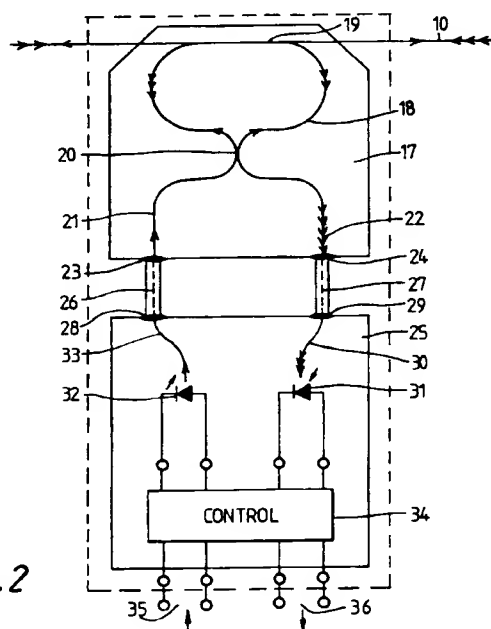


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(71) Applicants  
The Secretary of State for  
Defence, Whitehall,  
London SW1 2HB  
(72) Inventor  
Peter Gardner  
(74) Agents  
Ministry of Defence,  
P. B. Lockwood,  
Procurement Executive,  
Patents 1 A (4), Room  
1932,  
19th Floor,  
Empress State Building,  
Lillie Road,  
London SW6 1TR

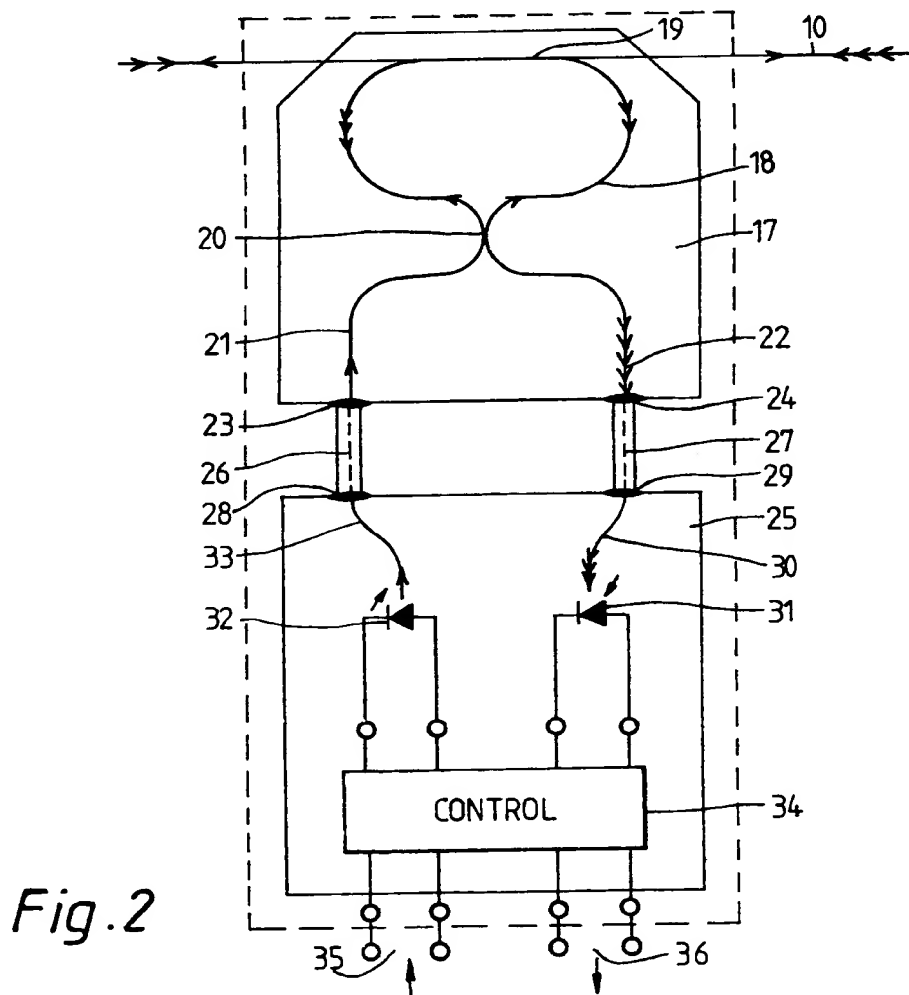
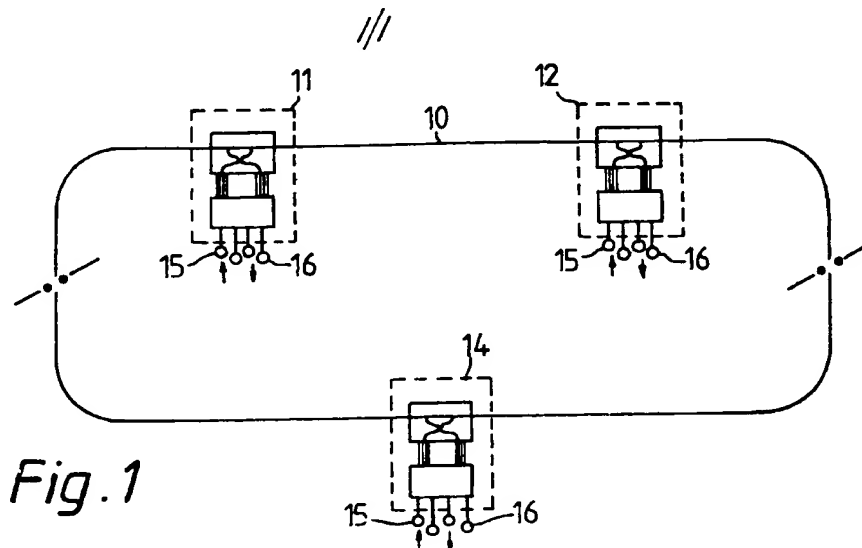
(54) Optical transmission loop  
systems

(57) In a data transfer system an interface unit (17) has a fibre optic path (18) to a star point (20) access coupled (14) to a bi-directional data highway (10). The path (18) leads to a transmitting transducer (32) and a receiving transducer (31) which interface via a control circuit (34) with data input 35 and output 36. Reception of a signal on the highway (10) further triggers the control circuit (34) to constructively transmit to reinforce signals on the highway (10).

Fig.2



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## SPECIFICATION

## Improvements in or relating to data transfer systems

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This invention relates to data transfer systems and in particular to systems in which data is transferred via an optical data highway.

Data transfer occurs in a communication system when information, encoded in the form of a signal, is transmitted from a first communication node and received at a second communication node. Increasing use is being made of the technique of data transfer via a data highway in which all communication nodes are connected to a continuous communication channel. With this technique communication between all connected nodes is possible provided adequate precautions are taken to ensure that the highway is not busy and that action is only taken at a receiving node on data intended for that node. The use of a data highway brings a number of advantages since communication between a plurality of nodes is provided and a complicated interconnection pattern between nodes is avoided. Such a technique is particularly attractive in circumstances where the installation of equipment must be accomplished in confined and difficult circumstances and where weight must be minimized, such as for example in an aircraft.

The data highway technique has been developed and is widely used where the encoded signal is in electrical form and has facilitated the implementation of systems in which processing power is available at the communication nodes, avoiding the need for a central dedicated processor. This leads to a reduction in the number of data transfers yielding improved efficiency, but the system as a whole is vulnerable to a communications failure.

In recent years there has been much activity in communication links in which data is encoded into an optical signal transmitted via a fibre optic. Use of fibre optics has particular advantages since data is not susceptible to corruption by electromagnetic interference and fibre optics have advantageous mechanical and bandwidth properties. Unfortunately fibre optics cannot be straightforwardly connected in a data highway configuration because signal energy losses at junctions and couplings where communication nodes are attached accumulate and effectively prevent the connection of a worthwhile number of nodes. In order to approximate to a highway configuration a discontinuous highway is employed in which conventional fibre optic links are connected between nodes, a received signal being regenerated on the next link by a transmitter. This arrangement can be put out of action completely by failure of a regenerative receiver/transmitter and so redundant links between at least alternate nodes must be provided to allow for possible failure. Unfortunately such redundancy negates the principal advantages of the data highway technique and as such has prevented the intro-

duction of viable data highway systems employing fibre optics.

65 According to the present invention a data transfer system includes a fibre optic highway for connection between communication nodes and a plurality of access coupled interfaces, at least one at each node and each having a receiving transducer and a transmitting transducer, the transducers being arranged for communication between nodes; each interface having a control circuit arranged to detect a data signal on the highway and to constructively transmit to reinforce the data signal.

75 Preferably each interface includes a fibre optic path leading from a bidirectional access coupling to a star point terminated at a transmitting termination and a receiving termination in optical contact with the transmitting transducer and the receiving transducer respectively. The transducers may advantageously be mounted in a separate interface unit, connected to a first interface unit by conventional fibre optic links.

In order that features and advantages of the present invention may be fully appreciated an embodiment will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, of which

Figure 1 represents a data transfer system in accordance with the present invention

Figure 2 shows in more detail an interface for use with the data transfer system of Figure 1.

In a data transfer system (Figure 1) a fibre optic data highway 10 is provided for communication between a plurality of communication nodes, such as nodes 11, 12 and 14. At each node is an interface to which communicating equipment may be connected via an input port and an output port, such as input port 15 and output port 16.

100 Each interface comprising a first interface unit, such as interface unit 17, and a second interface unit, such as interface unit 25, and wherein an access coupling is made to the data highway 10, (as may be more clearly seen in Figure 2, to which reference will now be made).

The first interface unit 17 includes a continuous fibre optic path 18 which is access coupled to the data highway 10 at coupling point 19. The fibre optic path 18 has a star point 20 resulting in branches 21 and 22 which lead to terminations 23 and 24 respectively. The fabrication and properties of an access coupling and a star point are known in the art and it will be appreciated by those skilled in the art that optical signals introduced at termination 23 will be bidirectionally transmitted on the data highway 10, and that a proportion of the energy of optical signals on the data highway 10 travelling in either direction will be conducted to termination 24.

115 Terminations 23 and 24 are coupled to a second interface unit 25 by conventional bidirectional fibre optic links 26 and 27 to terminations 28 and 29 respectively. A fibre optic path 30 conducts optical signals received at termination 29 to a photo diode receiving transducer 31. Optical signals from a light

emitting diode transmitting transducer 32 are conducted to termination 28 by a fibre optic path 33 for bidirectional onward transmission via the data highway 10 as described above, so that data may be transferred to and from other communication nodes via the highway 10.

The second interface unit 25 includes a control circuit 34 which is arranged to accept an electrical signal at an input point 35 and to control the transmitting transducer 32 to transmit a corresponding optical signal. The control circuit 34 produces an electrical output signal on output point 36 corresponding to optical signals received by the receiving transducer 31. Additionally the control circuit 34 is arranged to detect a data signal on the highway 10 which is received at the receiving transducer 31 and to trigger the transmitting transducer 32 to constructively transmit to reinforce the data signal.

It will be realized that the energy loss in the data signal as some energy is diverted towards the interface at the access coupling 19 is compensated by the reinforcing transmission so that any number of interfaces may be connected to the highway without the risk of impaired communication due to energy loss at the couplings (Figure 1). It will further be realized that the data highway 10 is continuous and thus, provided an adequate signal energy overhead is allowed, data transfer will not be impaired by failure of an interface, allowing communication between the nodes which remain operational even in the worst case of failure of adjacent interfaces. Since transmission from an interface is bidirectional a break in the highway 10 may also be sustained without impaired data transfer.

In the present embodiment a single fibre optic link forms the data highway 10. Signals on the highway may be in analogue or serial digital format. For analogue signals, the constructive transmission will be an amplified version of the received signal.

Where digital format signals are used the constructive transmission may preferably be a standard digital pulse, so that noisy signals are regenerated by reinforcement with a standard pulse as an interface is passed. A plurality of similar fibre optic links and interfaces may be paralleled to facilitate the transfer of parallel data.

New claims or amendments to claims filed on 5 Feb. 1982.

Superseded claims 1.

New or amended claims:-

1. A data transfer system including a fibre optic highway for correction between communication nodes and a plurality of access coupled interfaces, at least one at each node and each having a receiving transducer and a transmitting transducer, the transducers being arranged for communication between nodes: each interface having a control circuit arranged to detect a data signal on the highway and to constructively transmit to reinforce the data signal.

CLAIMS (filed 1-10-81)

The matter for which the applicant seeks protec-

tion is:

1. A data transfer system including a fibre optic highway for correction between communication nodes and a plurality of access coupled interfaces, at least one at each node and each having a receiving transducer and a transmitting transducer, the transducers being arranged for communication between nodes: each interface having a control circuit arranged to detect a data signal or a highway and to constructively transmit to reinforce the data signal.

2. A data transfer system as claimed in claim 1 and wherein each access coupled interface includes a fibre optic path to a star point and terminated at a transmitting termination and a receiving termination in optical contact with the transmitting transducer and the receiving transducer respectively.

3. A data transfer system as claimed in claim 2 and wherein at each interface the transmitting transducer and the receiving transducer are mounted in a second interface unit, and coupled to the transmitting termination and the receiving termination via conventional fibre optic links.

4. A data transfer system as claimed in claim 1, claim 2 or claim 3 and wherein the interfaces are bidirectionally access coupled.

5. A data transfer system as claimed in any preceding claim and adapted for analogue operation wherein constructive transmission is an amplified version of a received signal.

6. A data transfer system as claimed in any preceding claim including a parallel data highway and having a plurality of interfaces at each node.

7. A data transfer system substantially as herein described with reference to the accompanying drawings.

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